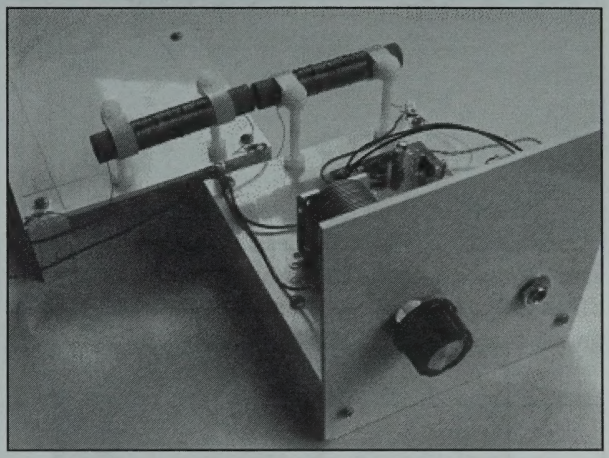
The Xtal Set Society Newsletter

Volumn 27, No.1 January 2017

In this issue (#153 January 2017)



Picture 1

Hot Rods Crystal Set

Phil, WØXI

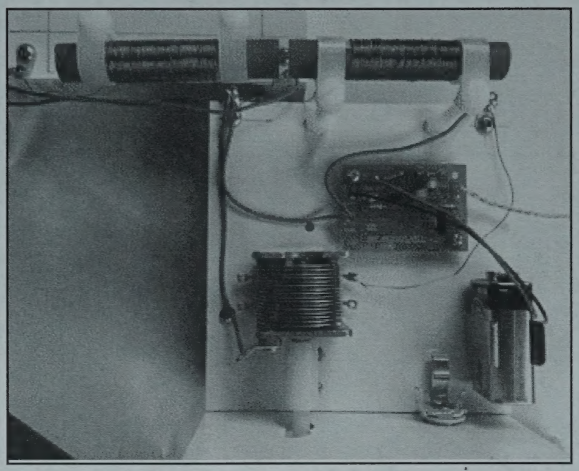
This crystal set has three unusual features, two 3-inch ferrite rods and an infinite impedance detector. Both R61-050-300 rods have 73 turns of #26 wire wound at their center, taking up about 40% of their 3-inch length; and, the detector is a Junction Field Effect Transistor (JFET) instead of the usual 1N34 diode or galena cat whisker detector.

With the two-rod configuration, the first rod acts as a part of the antenna while the second rod provides the radio's tuning circuit, labeled C3 in our circuit, with the usual air variable capacitor,. Each rod is set on its own platform – as shown in pictures 1 through 3. The setup enables the listener to adjust the distance between the rods in order to adjust volume and in some cases to reduce interference with a nearby station. These features are enhanced when using an infinite impedance detector in place of the usual 1N34 simple detector. This occurs because the infinite impedance detector does not load down (draw any current) from the tuned circuit as is the case with the usual diode detector.

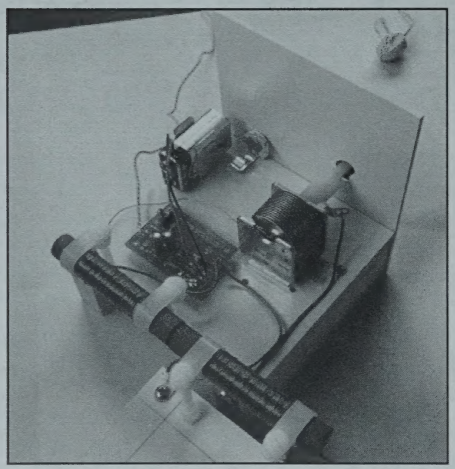
CONSTRUCTION

As noted in the three pictures (each with a different view) the two platforms have the same dimensions: 5 x 5 x 1.5 inches. They are topped off with a 5 x 5 by ¼" nylon sheet. While stock lasts, you'll find the sheets in the catalog section of the society website www.midnightscience.com. The two wood rails are 5 x 1.5 by ¾ inches. I use these for most projects and the wood is available in various lengths at various lumber retail outlets. Each 3" ferrite toroid is suspended 2 inches above its platform with nylon hardware. 73 turns of #26 wire are wound on the middle of each rod. The resulting inductance of each coil is about 230 microhenry [uH]. An assortment of these and other nylon parts can be found on our society website in the catalog section.

The radio platform contains the second ferrite rod coil, a 365 uuF air-variable tuning capacitor with mounting hardware, a small PCB for the remaining electronic parts of the receiver, a front panel, wiring, and a battery clip and 9V battery. The observant reader will note that I mounted a ¼-inch phone plug to the front panel (picture 1) to the right of the tuning knob. I got a bit lazy and simply soldered the leads of the piezo crystal earpiece to the radio PCB instead using the ¼-inch phono plug. At the bottom of the top view of the radio (picture 2) you can see the nylon shaft extension attached to the shaft of the air variable capacitor, thus enabling the addition of the front panel frequency tuning knob. This arrangement assists in reducing a change in frequency



Picture 2



Picture 3

while tuning due to hand capacitance effects. I didn't observe any detuning while adjusting the knob.

Finally, the assembly of the remaining parts for the radio section are mounted on the small 2" by 1.5" PCB as noted at the center of picture 2. This PCB was a leftover from a previous project so it was convenient to use it here. You'll have to supply a small piece of vector board or bare PCB and lay it out to wire your own. Simply follow the schematic described in the next section.

SCHEMATIC

Now let's walk through the schematic displayed in picture 4. The antenna and antenna coil L1 are shown in the upper left. The antenna wire is there, of course, to capture the incoming AM band radio waves. The current flows through C6 and L1 and terminates at the common earth ground used by both the antenna and the crystal radio set. The signal formed across L1 is coupled magnetically into the crystal set's tank circuit, L2 and C3. The radio's tank circuit is tuned to the desired frequency by adjusting C3. If we had built a traditional crystal set, we'd simply add a detector diode in series with the combination of a crystal ear piece and resistor in parallel and the set would be complete. However, we chose here to build what is called an infinite impedance detector with a junction field effect transistor (JFET) – a triode tube could have been used too.

The advantage of this arrangement is that the input impedance of the JFET is very high – for practical purposes infinite for our use here – thus the audio portion of the circuit does not load down the radio frequency tuned circuit L2-C3. As such the Q or quality of the tuned circuit is maintained. The result is that we get a bigger and sharper signal than we would with a simple diode detector. Another plus is that we get better fidelity of the audio signal.

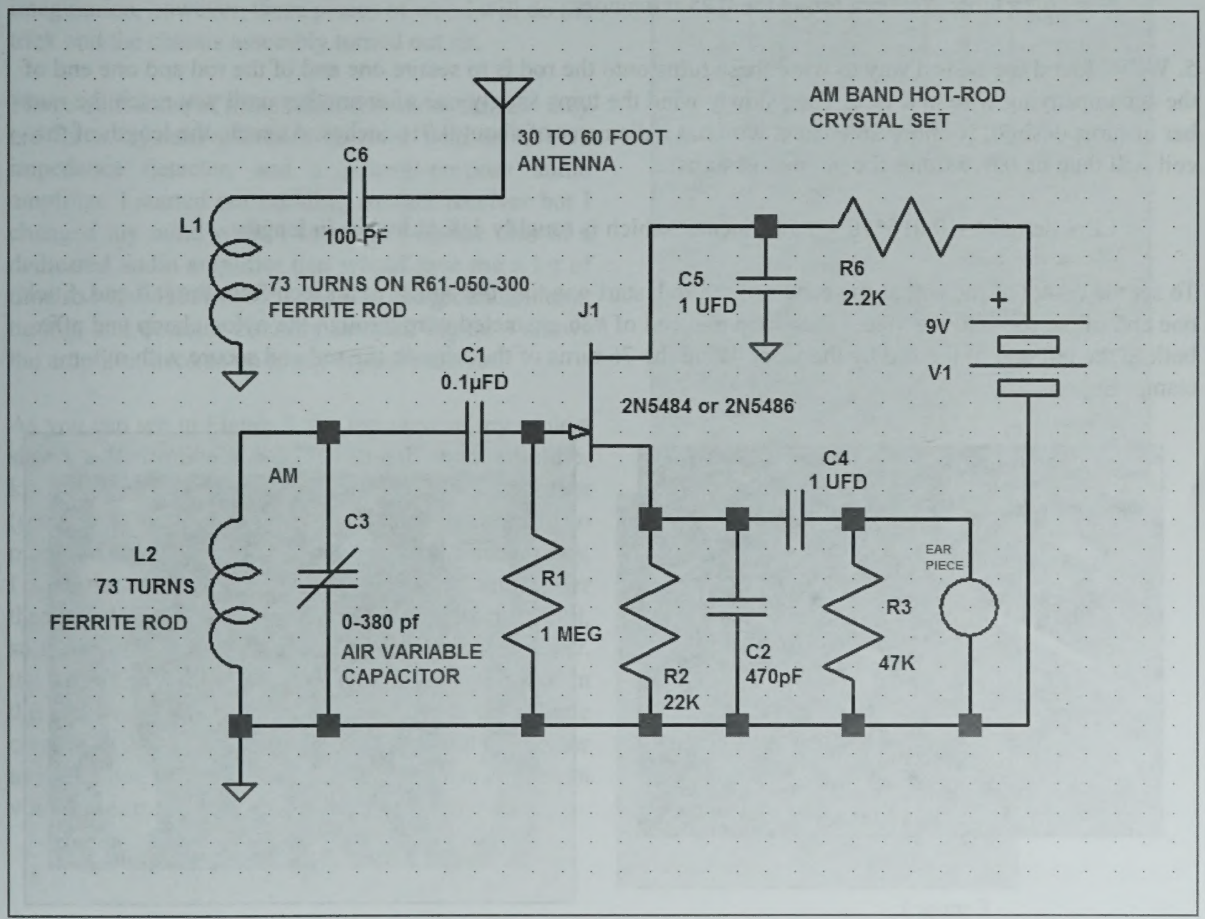
So you might ask, what is the purpose of the remaining parts attached to the source lead: R2, C2, C4, R3 and the ear piece. R2 sets the JFET bias; C2 syphons off the radio frequency (RF) energy; C4 decouples the DC source voltage from the output ear piece and R3 and the ear piece provide the audio. The secret of the ear piece is that it is really a capacitor; it's simply a couple of very thin metal pieces placed next to each other and held in place with a plastic form including an ear piece. Here is how it works. When the audio voltage initially appears at the top of R3 the ear piece (capacitor) is simply charged to that voltage peak. Then when the audio source at C4 goes down (due to a decrease in the voltage across L2 and C3) the voltage on the ear piece discharges through R3. The value of R3 is picked to work with the capacitance value of the earpiece in order to maintain the audio content.

Now some purist crystal set builders will reject this radio, saying that it's not a true crystal set because a battery is included in the set. However, we can argue that it's still a crystal set because we've not added a voltage amplifier; we are only providing bias for the JFET transistor and taking the signal output from the source lead of the JFET and attaching it to R2 in parallel with an EAR PIECE. As such the JFET does not provide any audio gain to the signal. And while we didn't do it, we could have replaced the battery with a second antenna and tuned circuit tuned to a strong local 50 kilowatt AM station to generate the small DC bias needed for the JFET. Maybe that's a project for next time. Alternatively, we could generate our bias with a bank of solar cells, etc.

OPERATION

Finally! We arrive at using the set and listening to some good ole AM broadcasting. For my setup, I use about 40 feet of #10 wire attached to the peak of the roof and feed it through the outside wall of my radio shack to my radio bench. The wire is attached to the top of C6 per the schematic.

I then tuned the radio to my local station, KLWN, 1320 kHz on the AM dial, and got a good strong signal. The 500 watt station's antenna is less than 10 miles south of my location. I adjusted the distance between the two coil rods and found that I could easily adjust the volume by moving the antenna coil relative to the set coil. In addition I obtained great audio. This was in the afternoon. I found four more stations, three in Kansas City, 50 miles to the east and one in Topeka Kansas, 28 miles to the west. Distant stations were heard during the night time hours, as usual. 73



INDUCTANCE OF A FERRITE ROD

Here's how you calculate the number of turns for a desired inductance for our 3 inch Ferrite Rod, R61-050-300, shown in our on-line catalog.

1. Suppose you wish to create a 0.25 milli-henry (0.25 mH) inductor using the rod. Keep in mind that 0.25 mH is the same as 250 uH (micro-henry), where "m" stands for milli- and "u" stands for micro-.

250 uH is the typical value used for a coil for the AM broadcast band.

2. Keep in mind that in most cases it is best to wind the coil in the middle of the rod. With this size of rod, one usually uses #26 enamel wire.

3. The number of turns, N, required to obtain the desired inductance is calculated with the following formula:

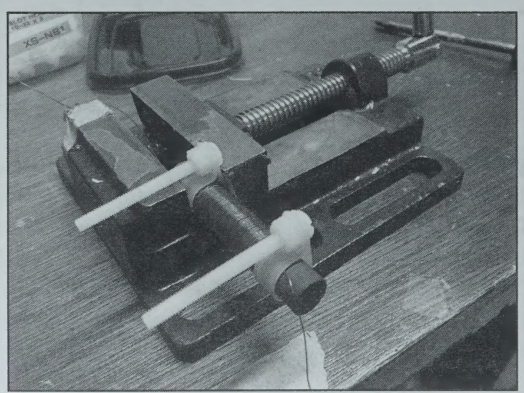
N = 1000 * SQRT (L [mh]/43), where SQRT stands for "taking the square root of."

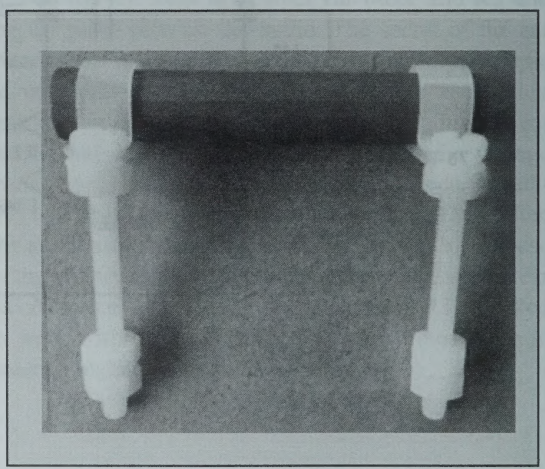
4. Let's plug in the numbers to see what we get:
N = 1000 * SQRT(0.25/43) = 1000 SQRT(0.5814) = 1000*0.7625.
N = 76.25 turns. You can forget the 0.25 remainder.

5. We've found the easiest way to wind these turns onto the rod is to secure one end of the rod and one end of the accompanying wire in a vice. Then slowly wind the turns snugly one after another until you reach the number of turns desired. Number 26 enamel wire has a diameter of about 0.016 inches. As such, the length of the coil will then be 0.016 times the number of turns:

LEN (length) = 0.016*76 = 1.216 inches, which is roughly 1 & ¼ inches in length.

To set the center of the coil at the center of the rod, start winding the coil ¾ of an inch from the left end. Stick one end of the rod into the vice. Then loop one end of #26 enameled wire through the nylon clamp and affix both to the left end of the rod by the vice. Wind the 76 turns of the wire on the rod and secure with nylon clamp. Enjoy!





Radio Chassis Construction And Application
By William H. Minardi, N1KDD

When I started building my first crystal set in over thirty years, I did not want to build it on a flat piece of breadboard. I wanted to do something a little fancier, so I decided to sketch out and construct a chassis similar to the design shown in The Popular Mechanic's Do It Yourself Encyclopedia that was published in 1955 (see Figures 1 and 2). Figure 3 shows the finished chassis that was ready for staining, drilling, and the mounting of radio parts.

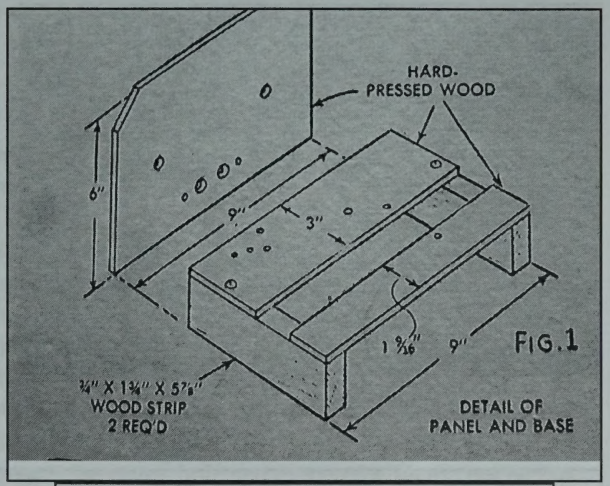


FIG.1

I purchased the raw materials from Lowe's when I was driving home from work one day. Figure 2 also has the part numbers for the wood if you decide to go to Lowe's. The front panel is a piece of birch paneling and the base and cross-members are two different size strapping. And I admit that I am no carpenter by any stretch of the imagination, however, these pieces of wood will do the trick and the chassis assembly turned out ok.

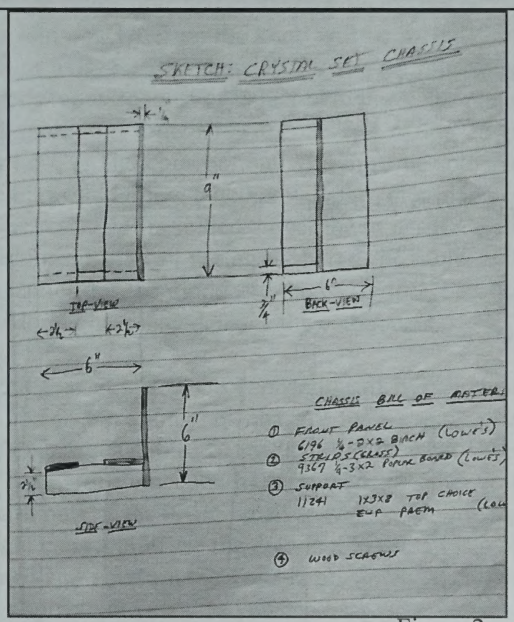


Figure 2

I have built three of these radio chassis so far, and they are for a crystal receiver, a receiver with an infinite impedance detector, and a general-purpose audio amplifier. I started out building another receiver but I changed my mind when I came up with the idea of a dedicated audio amplifier that would save me a lot of time so I could focus on the antenna and ground system, tuning, and detector circuitry instead. Figure 4 shows the amplifier hooked up to my crystal receiver.

As you can see in Figure 5, the top view of my project shows a Radio Shack # 2770350 half- watt amplifier kit driving a Nutone (Sensonic) # MS-8W4S speaker (see Figure 6B) and a cheap and dirty patch-cord to plug into any receiver project. As far as the audio goes, I did not want to "re-invent the wheel" and suffer through designing and building an amplifier circuit, so I assembled the kit. Coupled to the crystal receiver, the two units work together very well. If you notice in the pictures (Figures 4 and 5) that there is no volume control on the amplifier, that is because I did not bother to install one yet. The amp circuit board has a trim-pot volume control in it which will suffice for now.

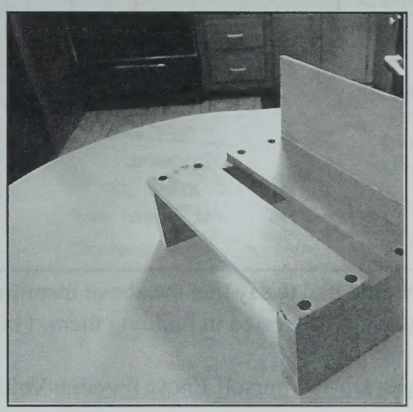


Figure 3

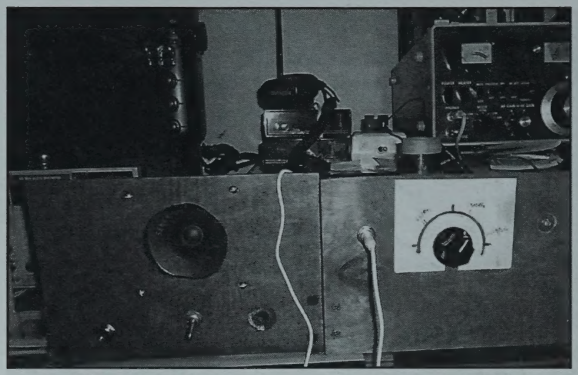


Figure 4

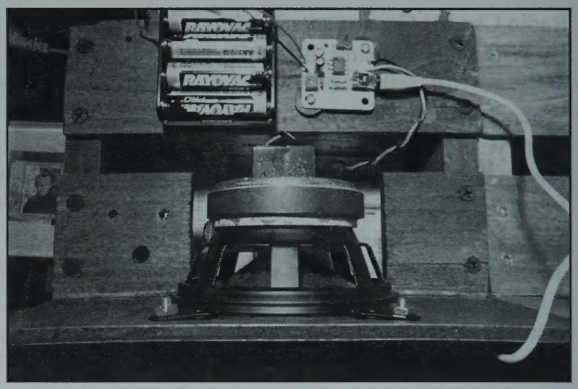
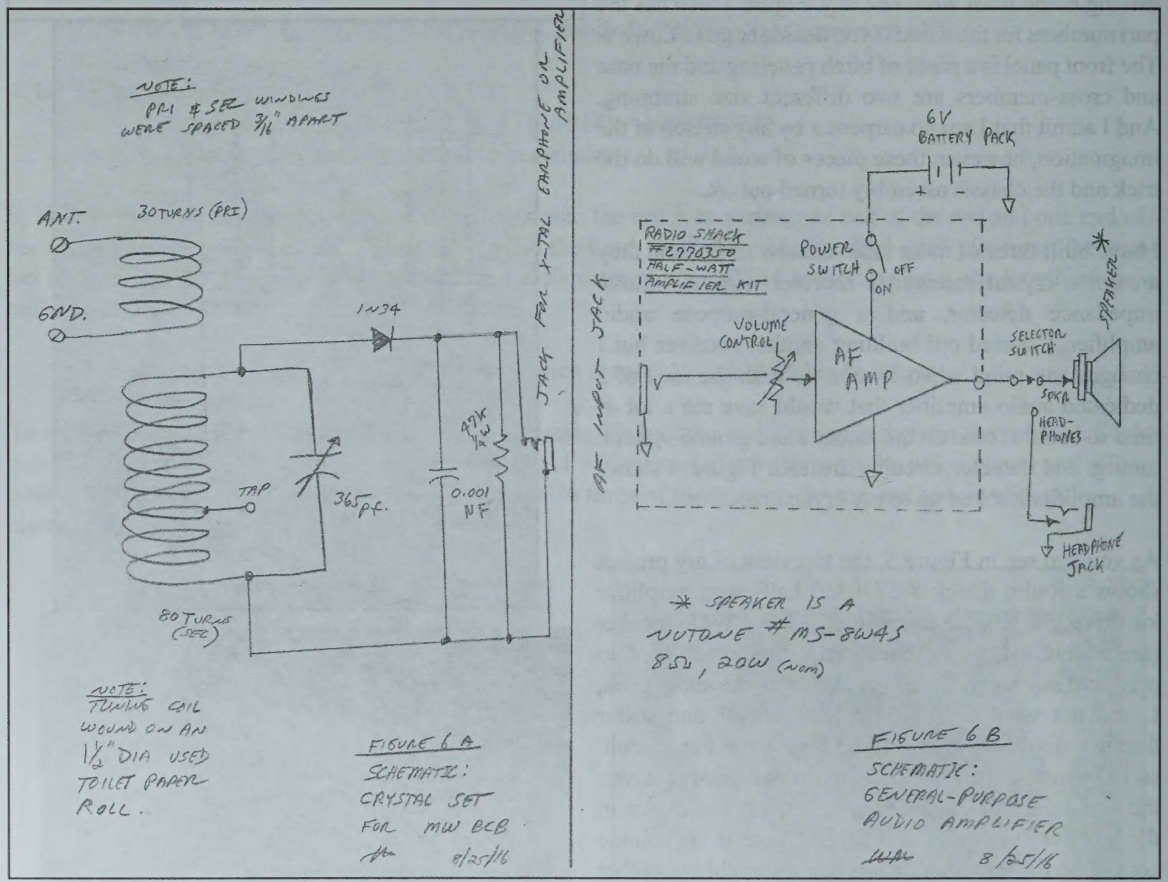


Figure 5



In conclusion, I would like to say that the above mentioned projects were fun to build and I was pleased with their performance. If you are interested in building them, I hope you have the same enjoyment as I did.

Reference:

Popular Mechanics Do-It-Yourself Encyc1opedia, Volume IX, 1955, New York, Popular Mechanics Company: Page 59

The Amroh Jam pot AM-Receiver
A receiver for less than Seven Dutch Guilders (± $ 4.00)
by Willem Verhoog

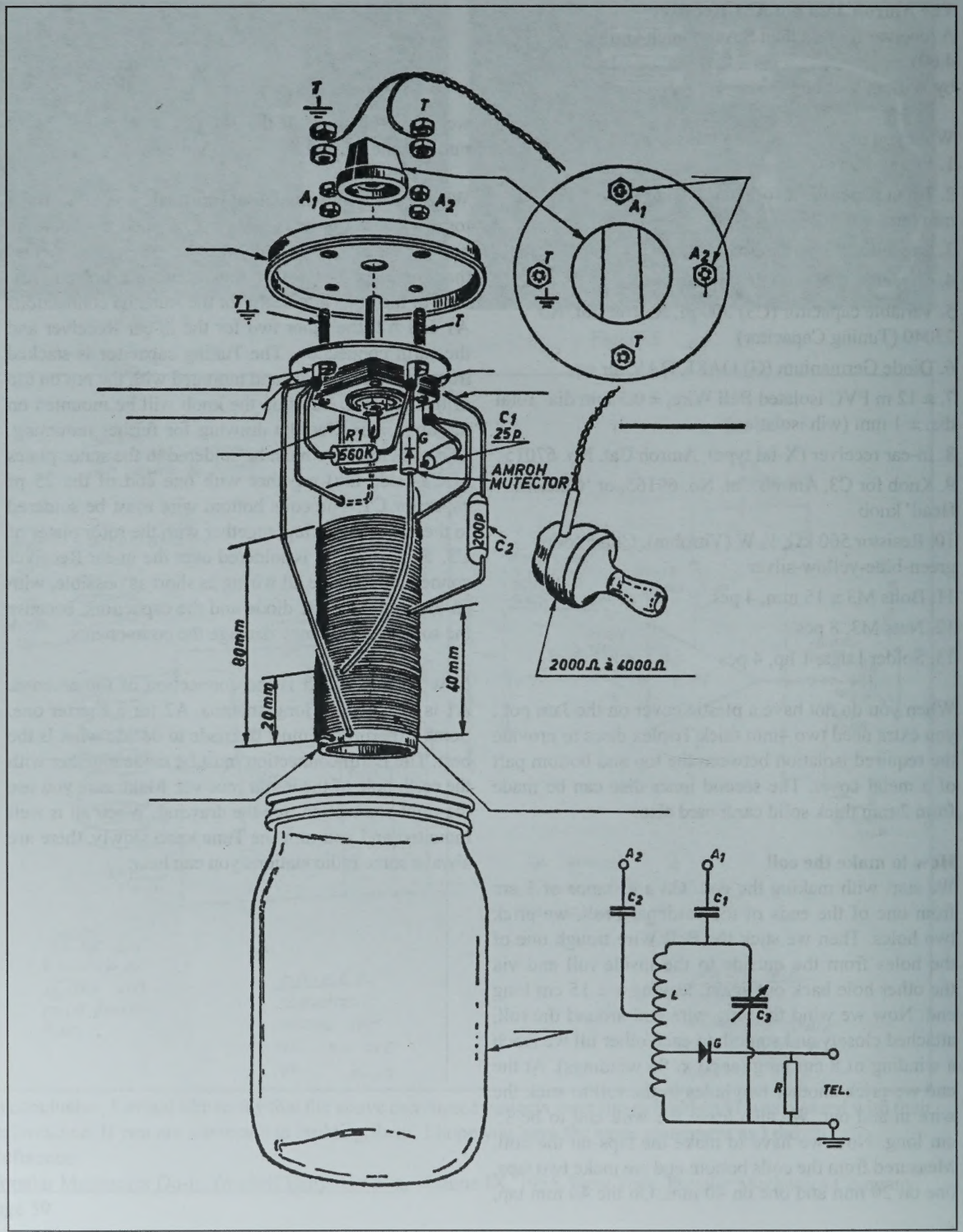
What you need for building this receiver:
1. Empty Jam pot
2. Toilet paper inner roll, diam. 38 to 40 mm Ø, 105 mm long
3. Capacitor (C1) 25 pf (Mial)
4. Capacitor (C2) 200 pf (Mial)
5. Variable capacitor (C3) 500 pf, Amroh Cat. No. 23040 (Tuning Capacitor)
6. Diode Germanium (G) OA81, OA85 or eq.
7. ± 12 m PVC isolated Bell Wire, ± 0.5 mm dia. Total dia. ± 1 mm (wih isolation)
8. In-ear receiver (X-tal type), Amroh Cat. No. 67015
9. Knob for C3, Amroh Cat. No. 69165, or 'Chicken Head' knob
10. Resistor 560 kΩ, ½ W (Vitrohm), Color code: green-blue-yellow-silver
11. Bolts M3 x 15 mm, 4 pcs
12. Nuts M3, 8 pcs
13. Solder Lugs, 1 lip, 4 pcs

When you do not have a plastic cover on the Jam pot , you extra need two 4mm thick Triplex discs to provide the required isolation between the top and bottom part of a metal cover. The second inner disc can be made from 2 mm thick solid cardboard also.

How to make the coil
We start with making the coil. On a distance of 1 cm from one of the ends of the cardboard roll, we prick two holes. Then we stick the Bell Wire trough one of the holes from the outside to the inside roll and via the other hole back out again, leaving a ± 15 cm long end. Now we wind the long wire end around the roll, attached closely and smooth to each other till we reach a winding of 8 cm long (approx. 86 windings). At the end we prick another two holes in the roll to stick the wire in and out. We also leave the wire end to be 15 cm long. Now we have to make the taps on the coil. Measured from the coils bottom end we make two taps, one on 20 mm and one on 40 mm. On the 40 mm tap, we solder one wire of the 200 pf capacitor, on the 20 mm tap one wire of the diode (Mutector).

When the isolated caps (discs) are made, we mount them together with the bolts and nuts, in such way that the bolts heads are on the side of the smallest disc. Before that we place the solder lugs under the bolts heads. Two of the bolts are meant for the Antenna connections A1 and A2, the other two for the in-ear Receiver and the earth connection. The Tuning capacitor is stacked trough the center hole and mounted with the nut on top of the Jam pot. Later on the knob will be mounted on the 6mm axis. See the drawing for further mounting. The coils top wire must be soldered to the stator plates of C3 (side lug) together with one end of the 25 pf capacitor C1. The coils bottom wire must be soldered to the Earth solder lug, together with the rotor plates of C3. The resistor R is soldered over the in-ear Receiver connections. Leave all wiring as short as possible, with an exception for the diode and the capacitors, because the soldering heat may damage the components.

Now all that is left is the connection of the antenna. A1 is meant for a long antenna, A2 for a shorter one. Some experiments must be made to decide what Is the best. The Earth connection must be made together with the earth pole of the in-ear receiver. Make sure you use the right connection, see the drawing. When all is well mounted and you turn the Tune knob slowly, there are always some radio stations you can hear.



With a few extra costs it is possible to expand the receiving possibilities, par example Radio Veronica. In any way a good receiving signal is possible in the Western part of Holland. The extra costs to be made are less than 4 Guilders, which is no big deal for most of us. The required extra components are:

1. Resistor R1, 47 kΩ ½ Watt
2. Resistor R2, 10 kΩ ½ Watt
3. Capacitor (paper) C4, 2200 pf
4. Transistor GFT 20/15, OC3, OC4, GFT 21/15 or AC125 (Germanium PNP)
5. Battery 1,5 Volt, p.a. Berec D 14

The circuit diagram is just before the transistor equal to the standard Jam pot Receiver. The transistor picks up the (audible) audio signal over R1 and amplifies it to R2. The in-ear receiver is connected in parallel over R2. The battery is needed to keep the transistor doing its job; it needs a power supply.

What to keep in mind

The Xtal diode (Mutector) poles in the senior version have to be switched (+ and –, c.q. anode and cathode), compared to the original version. R2 (560 kΩ) must be replaced by a 47 kΩ resistor.

Near to an AM-Transmitter it is possible to receive a distorted signal. In this case use a small antenna connected to A1 and the 25 pf capacitor, also connected to A1 has to be changed into 10 pf.

Energy saving circuit

This Receiver has the odd quality not to take energy from the battery when there is no receiving signal. When you remove the antenna the battery automatically rests and will not get empty.
So, much success with this receiver and ..... Radio Veronica.

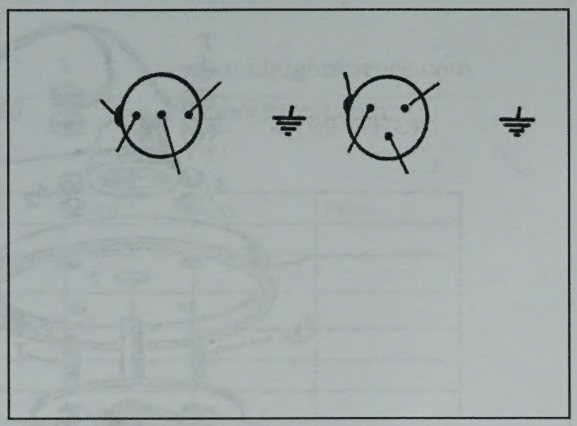


Figure 3. Two possible Transistor shapes

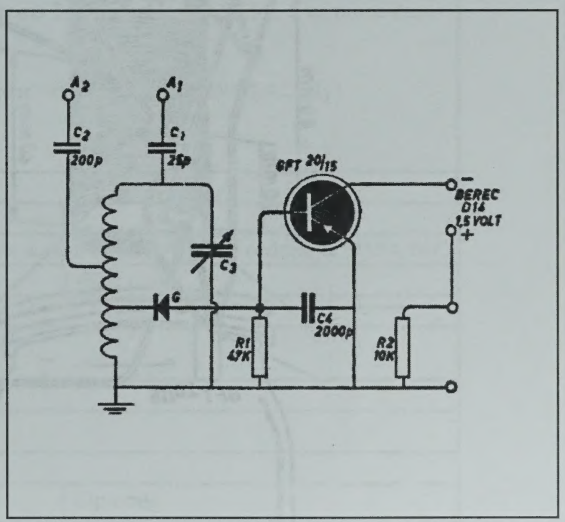
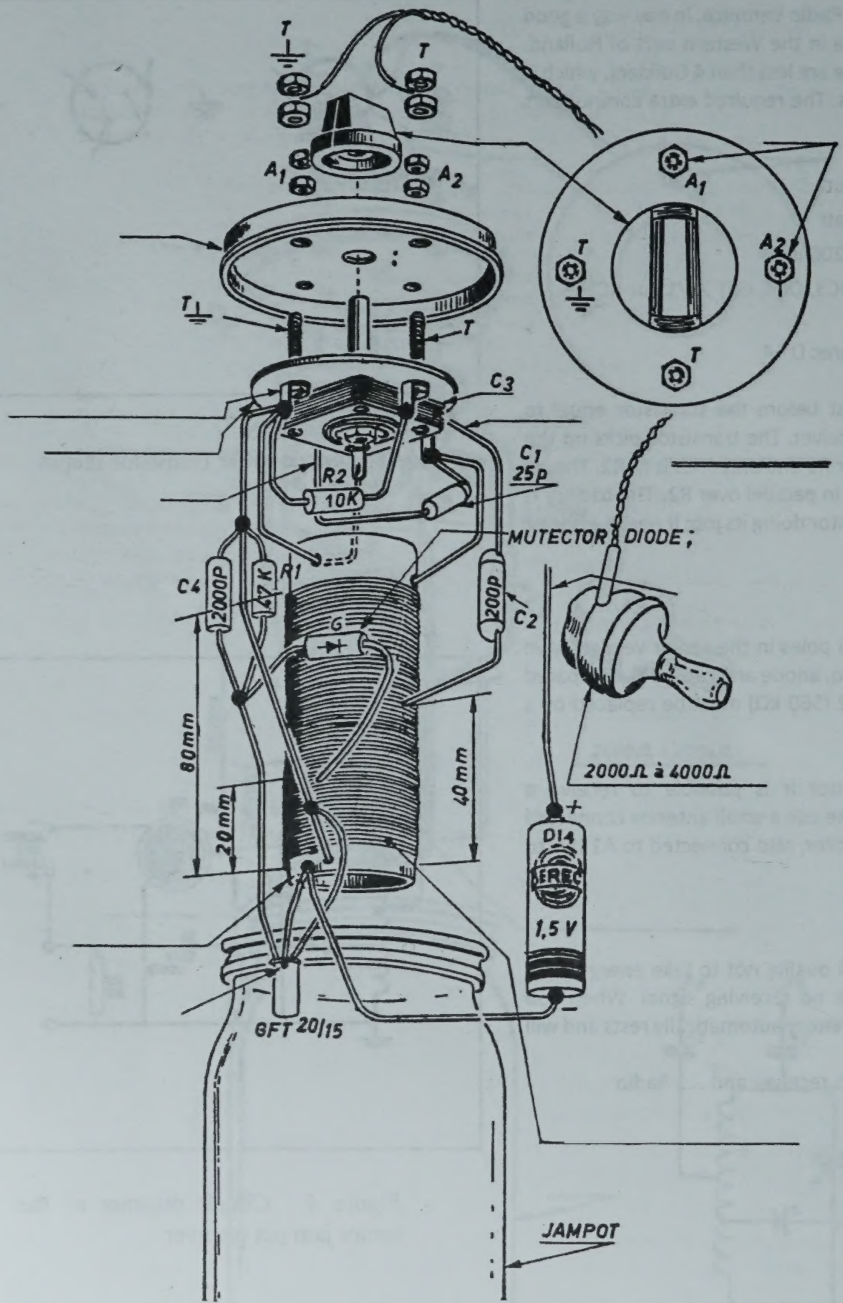


Figure 4. Circuit diagram of the senior jam pot receiver



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We accept checks, money orders, or VISA/MC				
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Orders are filled promptly, but allow 2-3 weeks for delivery				

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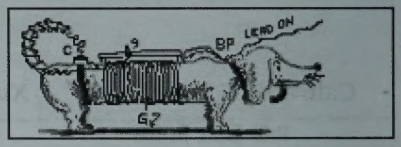


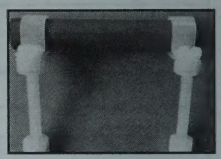
1-3-17

We are dedicated to once again building and experimenting with radio electronics, often—but not always—through the use of the crystal set, the basis for most modern day radio apparatus. This newsletter helps support our goal of producing excellent quality technical books that encourage learning and building.

Please send articles and correspondence to the following address:
PO Box 3636, Lawrence KS 66046

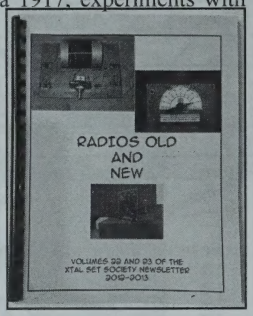
Founder &Columnist– Philip N. Anderson, WØXI
Editor & Queen Mum- Patricia, NØGZZ
Columnist- J.K. Fenton
Columnist- Dan Petersen, W7OIL email: dan.w7oil@gmail.com

Nylon Form for Rod

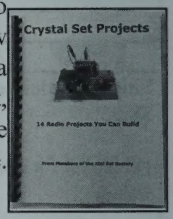


This set of nylon parts combine as a form for the ferrite rod, thus preserving the Q of the rod mounted above a chassis. The Rod is not included. Nylon Form rod $2.50

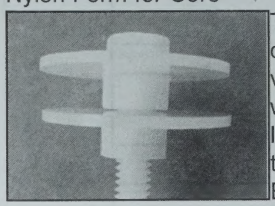
RADIOS OLD AND NEW is volumes 22 and 23 of the Xtal Set Society Newsletter. A wide range of topics and projects are covered in 2012: aerials circa 1917, experiments with regens, grounding and reducing noise in your station, experimenting with spider coils, a 2 for 1 regen set, primer for the 602 mixer at 40 kHz, a modern TRF AM receiver. The following topics for 2013 are: JFET Drain-Output set, a foxhole radio, feedback for beginners, a modern day regen, the universal crystal set, The Albert Hull Memorial Dynatron Regenerative Receiver, adding absorption wave traps, from telegrapher to coherer, a 700 Hz oscillator featuring a quadrature architecture, and more. Vol 23 $15.95



Crystal Set Projects You Can Build is a collection of 14 radio projects designed by members of the Xtal Set Society. The members hope that by creating this book they will help others to discover this great hobby while at the same time learning basic radio concepts. Here's a sampling: Low Budget Xtal Set, A Loop Antenna Crystal Set, The Den Two Crystal Set, Build a Matchbox Crystal Radio, The triple Tuned Crystal Set and more. XCP $12.95



Nylon Form for Core



These nylon plastic pieces combine as a form for the various ferrite toroid coils we offer. The form is low loss thus preserving the Q of the coil wound on the form. Extending them above the chassis - which might be metal or fiber board also preserves the coil Q. nycore-frm $2.50

R-L-C-D Assortment

This assortment has nearly all the parts to build a basic am crystal set: 100 pf cap, 330 pf cap, am-band toroidal coil form (ft-82-61), 47k and 100k resistors and a 1n34 diode. RLCD 5.95

Spider Coil Form

This 5 by 6 by 1/8th inch ABS plastic form includes nine NC punched radial slots and five mounting holes. This size supports 250 uH coils when used with #22 or #26 enamel, or 150/45 Litz wire found on our website. The coil shown consists of 56 turns of 150/45 Litz, with a 1.6 inner diameter and 4.2 outer diameter. An instruction sheet including formula and table ships with the form. In addition, you'll find the spider formulas for number of turns for a given inductance on our formulas-calculators web page on our main site, www.midnightscience.com Spider Coil Form Cat #SpCO $9.95 each.